Appendix B
Quality Assurance History — Automated Woodstove Emission Sampler

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1. Quality Assurance Plan for: The Northeast Cooperative Woodstove Study, Vol. II, EPA/600/7-87-026b (NTIS PB88-140777), November 1987.

    - RTI[1] Review and Acceptance of Quality Assurance Plan, February 1986
    - RTI Interim Audit of Data Quality, December 1986
    - RTI Final Technical System and Performance Evaluation Audit, April 1987
    - RTI Final Audit of Data Quality, November 1987

2. Quality Assurance Plan for: Field Performance of Advanced Technology Woodstoves in Glens Falls, New York, 1988-1989, Vol. II, EPA/600/7-90-019b (NTIS PB91-125658), October 1990.

    - RTI Review and Acceptance of Quality Assurance Plan, December 1988
    - RTI Technical Systems and Performance Evaluation Audit, February 1989
    - RTI Second Performance Audit, May 1989
    - RTI Interim Audit of Data Quality, November 1989

3. Quality Assurance Plan for: Woodstove Emission Sampling Methods Comparability Analysis and In-situ Evaluation of New Technology Woodstoves, EPA/600/7-89-002 (NTIS DE89-001551), January 1989.

    - RTI Review and Acceptance of Quality Assurance Plan, March 1987
    - RTI Final Audit Report, April 1987

4. Technical system and performance evaluation audits were conducted by RTI on automated emission sampler protocols and data for masonry heaters. Final audit reports were completed April 1992. The audits were conducted to support the inclusion of

[1] Research Triangle Institute (RTI) was under contract with the U.S. EPA to provide independent third party quality assurance audits.

masonry heater data in section 1.10 of AP-42.

Appendix C
Summary of Automated Emissions Sampler Data by Test

AWES-Emissions Results

Project Name: ERG/EPA

Residence Location: Klamath Falls, Oregon USA
Test Run Number: Week B
Test Period Start Date/Time: 12/04/98 05:47:00 PM
Test Period End Date/Time: 12/10/98 02:32:00 PM
Stove Model Tested: **KF01: Quadrafire 2100 Non-Catalytic**
Stove Type: New Tech/Non-Catalytic

Time

Total Test Period	141.00	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	93.5	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	66.3%	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	493	Degrees F	256	Degrees C
Test Facility Ambient Temperature	62	Degrees F	17	Degrees C

ESS Settings

ESS Sampling Rate	0.985	L/Minute
Sample Cycle Duration	15.00	Minutes
Sample Time Per Sample Cycle	120	Seconds

Particulate Emissions

Emission Factor	8.7	G/Kg
Emission Rate	10.8	G/Hour
Concentration	466	Mg/M3

Fuel

Total Fuel Used	145.0	KG With Moisture
Average Fuel Moisture	24.5%	Percent Dry Basis
Total Fuel Burned	116.5	KG Dry
Average Burn Rate During Stove Operation	1.2	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	47.5%
XAD-2	12.1%
Filter	40.5%
Total	100%

Average Flue-Gas Concentrations

Oxygen (AWES)	15.54	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume Is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)

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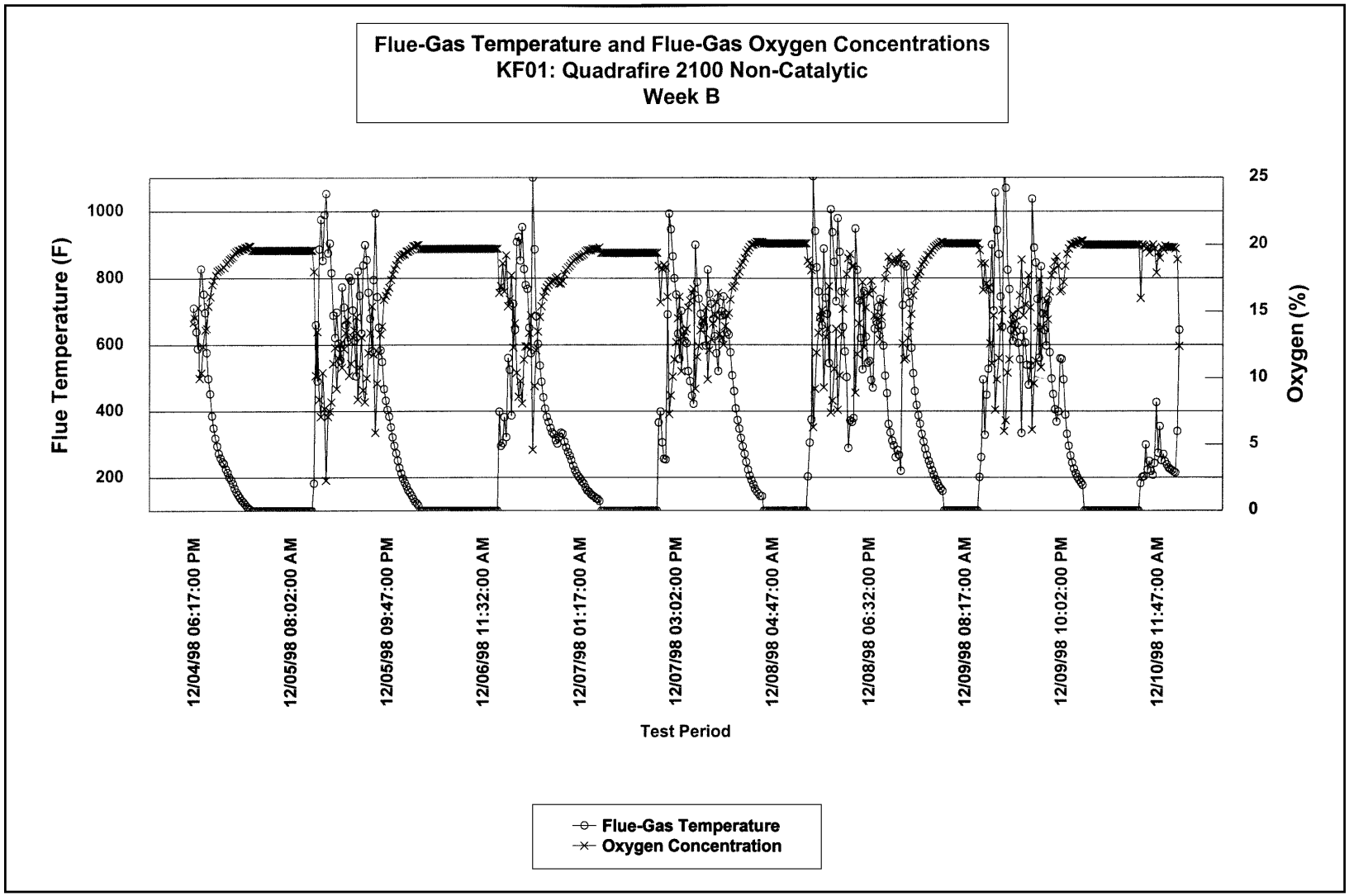

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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location: Klamath Falls, Oregon USA
Test Run Number: Week B
Test Period Start Date/Time: 12/04/98 05:47:00 PM
Test Period End Date/Time: 12/10/98 02:32:00 PM
Stove Model Tested: **KF01: Quadrafire 2100 Non-Catalytic**
Stove Type: New Tech/Non-Catalytic

Time

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Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	93.5	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	66.3%	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	493	Degrees F	256	Degrees C
Test Facility Ambient Temperature	62	Degrees F	17	Degrees C

ESS Settings

ESS Sampling Rate	0.985	L/Minute
Sample Cycle Duration	15.00	Minutes
Sample Time Per Sample Cycle	120	Seconds

Particulate Emissions

Emission Factor	8.7	G/Kg
Emission Rate	10.8	G/Hour
Concentration	466	Mg/M3

Fuel

Total Fuel Used	145.0	KG With Moisture
Average Fuel Moisture	24.5%	Percent Dry Basis
Total Fuel Burned	116.5	KG Dry
Average Burn Rate During Stove Operation	1.2	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	47.5%
XAD-2	12.1%
Filter	40.5%
Total	100%

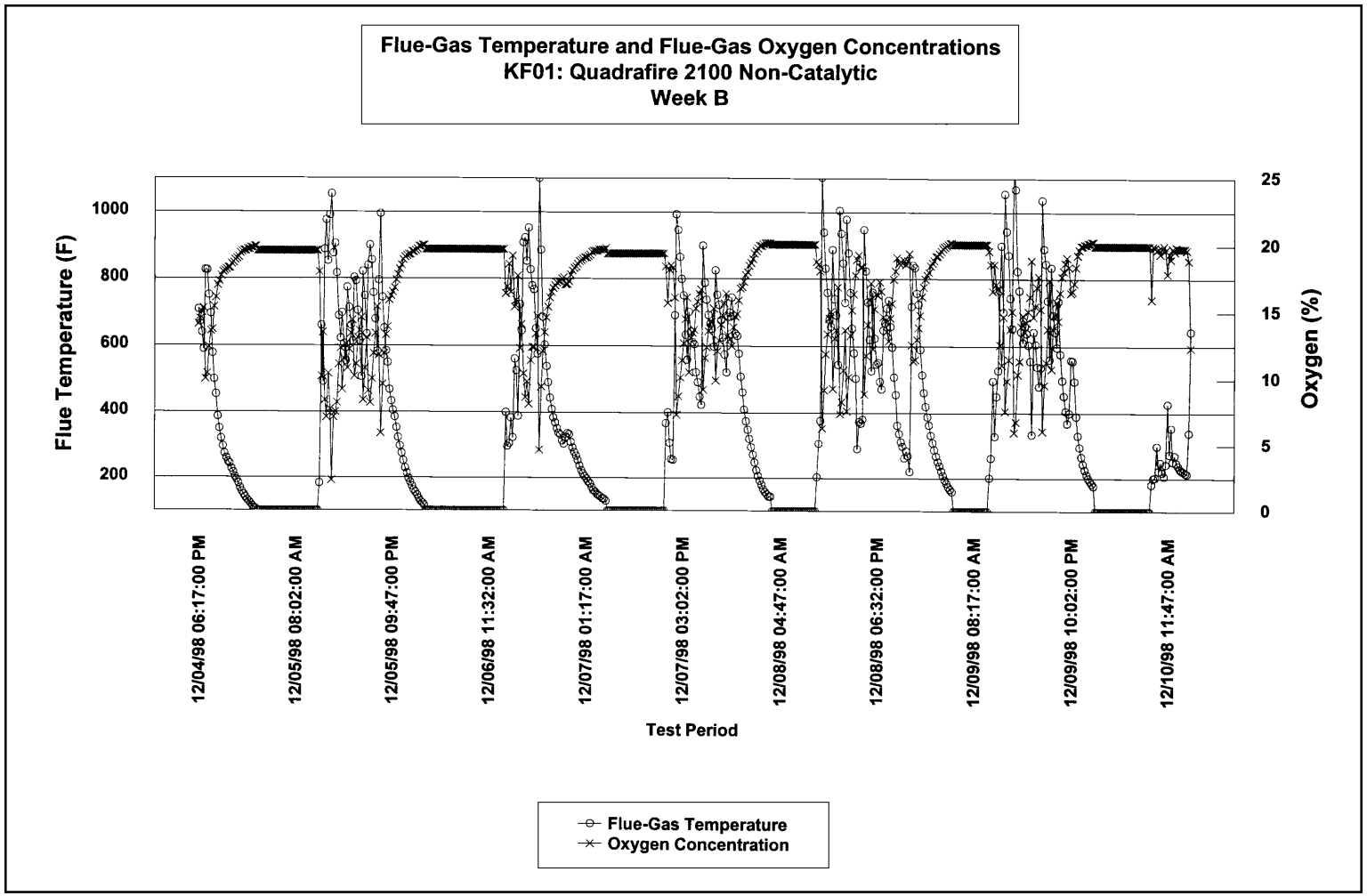
Average Flue-Gas Concentrations

Oxygen (AWES)	15.54	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location: Klamath Falls, Oregon USA
Test Run Number: Week C
Test Period Start Date/Time: 12/10/98 04:02:00 PM
Test Period End Date/Time: 12/16/98 02:32:00 PM
Stove Model Tested: **KF01: Quadrafire 2100 Non-Catalytic**
Stove Type: New Tech/Non-Catalytic

Time

Total Test Period	**142.75**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**43.25**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**30.3%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**482**	Degrees F	**250**	Degrees C
Test Facility Ambient Temperature	**72**	Degrees F	**22**	Degrees C

ESS Settings

ESS Sampling Rate	**0.985**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**4.8**	G/Kg
Emission Rate	**6.5**	G/Hour
Concentration	**221**	Mg/M3

Fuel

Total Fuel Used	**77.3**	KG With Moisture
Average Fuel Moisture	**31.4%**	Percent Dry Basis
Total Fuel Burned	**58.8**	KG Dry
Average Burn Rate During Stove Operation	**1.4**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**52.1%**
XAD-2	**8.1%**
Filter	**39.8%**
Total	**100%**

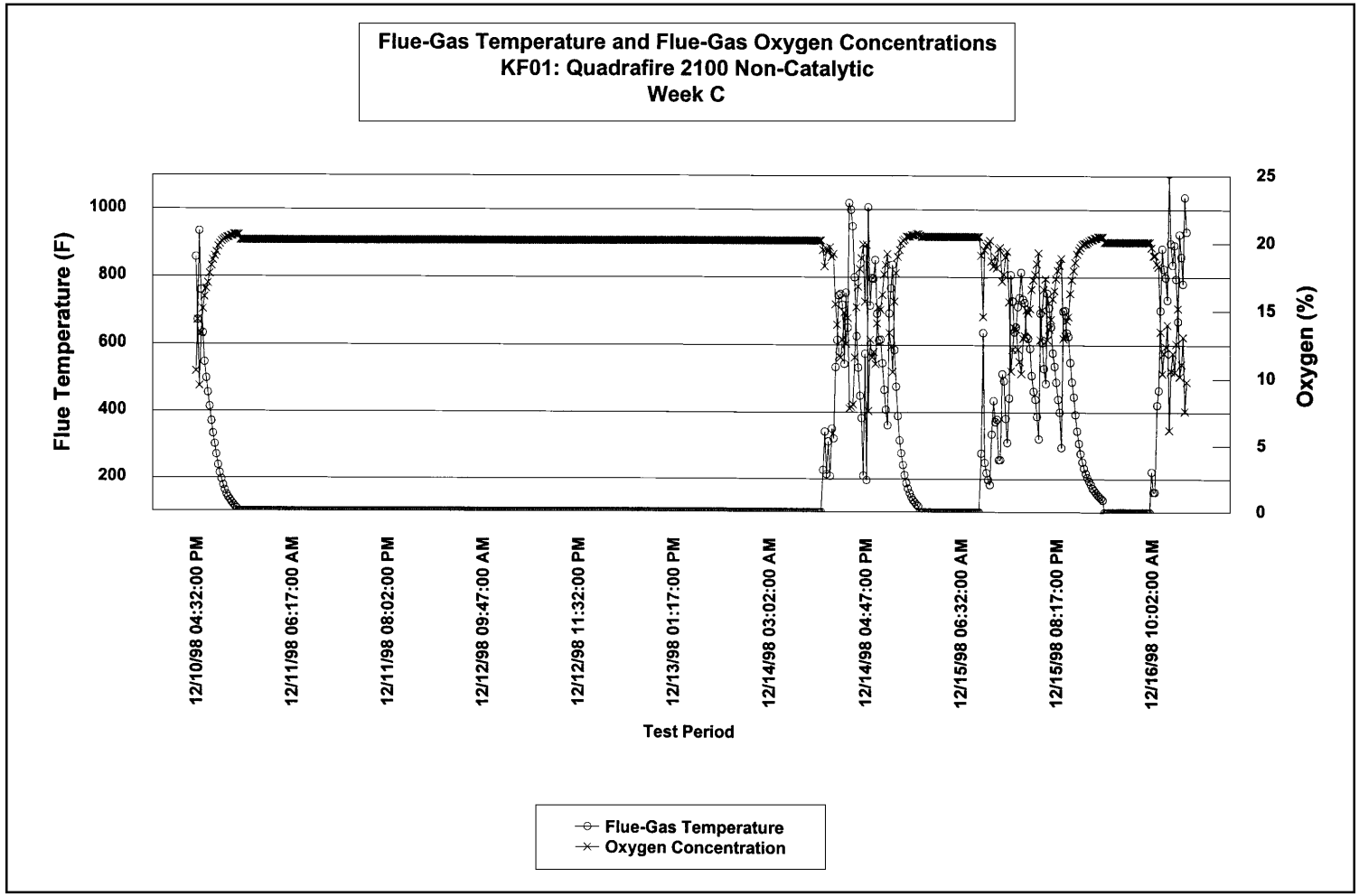
Average Flue-Gas Concentrations

Oxygen (AWES)	**16.29**	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location:	Klamath Falls, Oregon USA
Test Run Number:	**Week A**
Test Period Start Date/Time:	11/08/98 12:01:54 PM
Test Period End Date/Time:	11/15/98 11:47:00 AM
Stove Model Tested:	**KF02: Pacific Energy Standard 27 Non-Catalytic**
Stove Type:	New Tech/Non-Catalytic

Time

Total Test Period	**168.00**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**168**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**100%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**448**	Degrees F	**231**	Degrees C
Test Facility Ambient Temperature	**67**	Degrees F	**19**	Degrees C

ESS Settings

ESS Sampling Rate	**1.124**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**5.7**	G/Kg
Emission Rate	**5.5**	G/Hour
Concentration	**362**	Mg/M3

Fuel

Total Fuel Used	**196.4**	KG With Moisture
Average Fuel Moisture	**20.8%**	Percent Dry Basis
Total Fuel Burned	**162.6**	KG Dry
Average Burn Rate During Stove Operation	**1.0**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**56.2%**
XAD-2	**18.8%**
Filter	**24.9%**
Total	**100%**

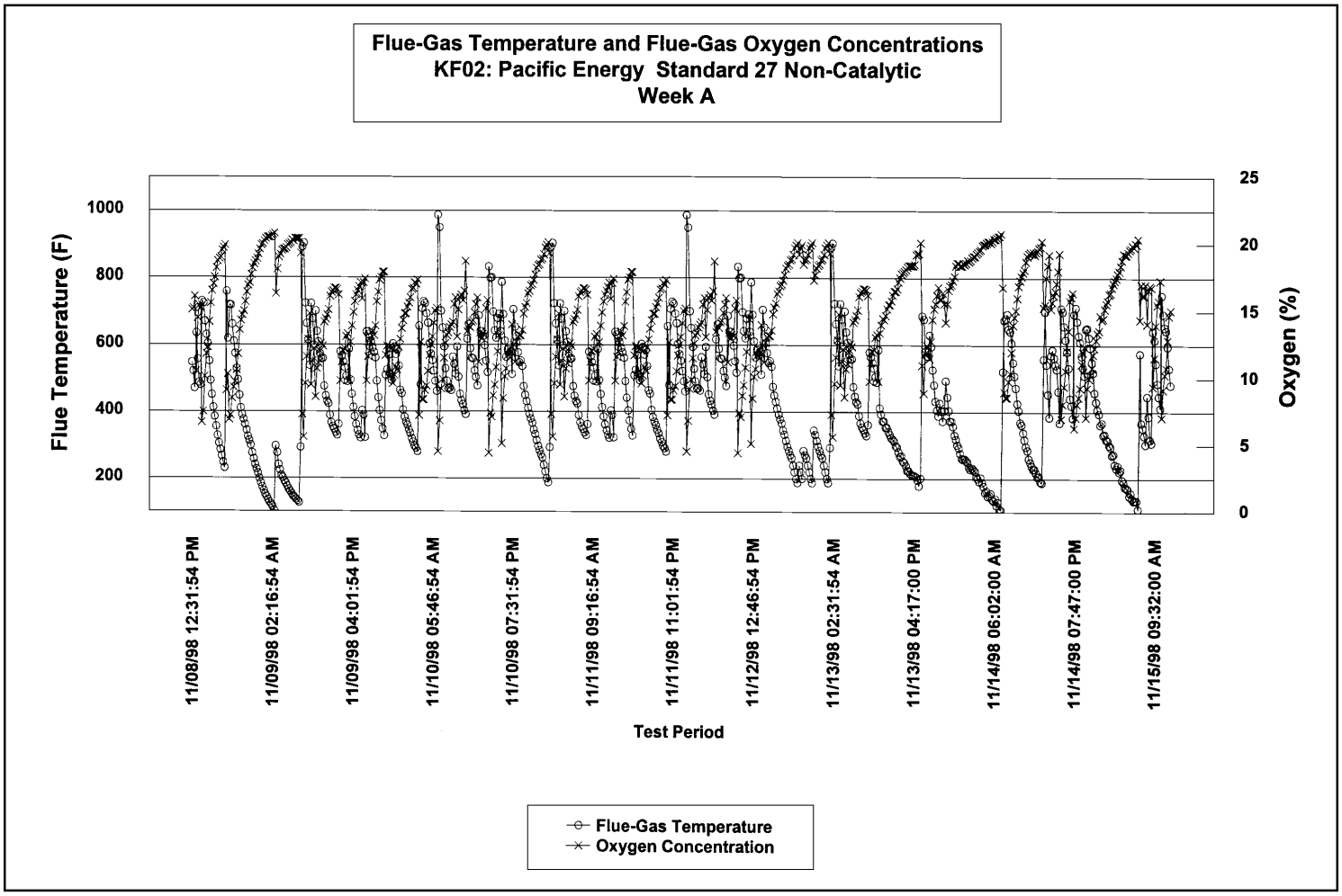
Average Flue-Gas Concentrations

Oxygen (AWES)	**14.53**	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location:	Klamath Falls, Oregon USA
Test Run Number:	**Week B**
Test Period Start Date/Time:	12/02/98 09:47:00 AM
Test Period End Date/Time:	12/09/98 09:32:00 AM
Stove Model Tested:	**KF02: Pacific Energy Standard 27 Non-Catalytic**
Stove Type:	New Tech/Non-Catalytic

Time

Total Test Period	**168.00**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**163.75**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**97.5%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**412**	Degrees F	**211**	Degrees C
Test Facility Ambient Temperature	**57**	Degrees F	**14**	Degrees C

ESS Settings

ESS Sampling Rate	**1.124**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**5.1**	G/Kg
Emission Rate	**5.3**	G/Hour
Concentration	**326**	Mg/M3

Fuel

Total Fuel Used	**207.6**	KG With Moisture
Average Fuel Moisture	**21.5%**	Percent Dry Basis
Total Fuel Burned	**170.9**	KG Dry
Average Burn Rate During Stove Operation	**1.0**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**40.4%**
XAD-2	**26.4%**
Filter	**33.3%**
Total	**100%**

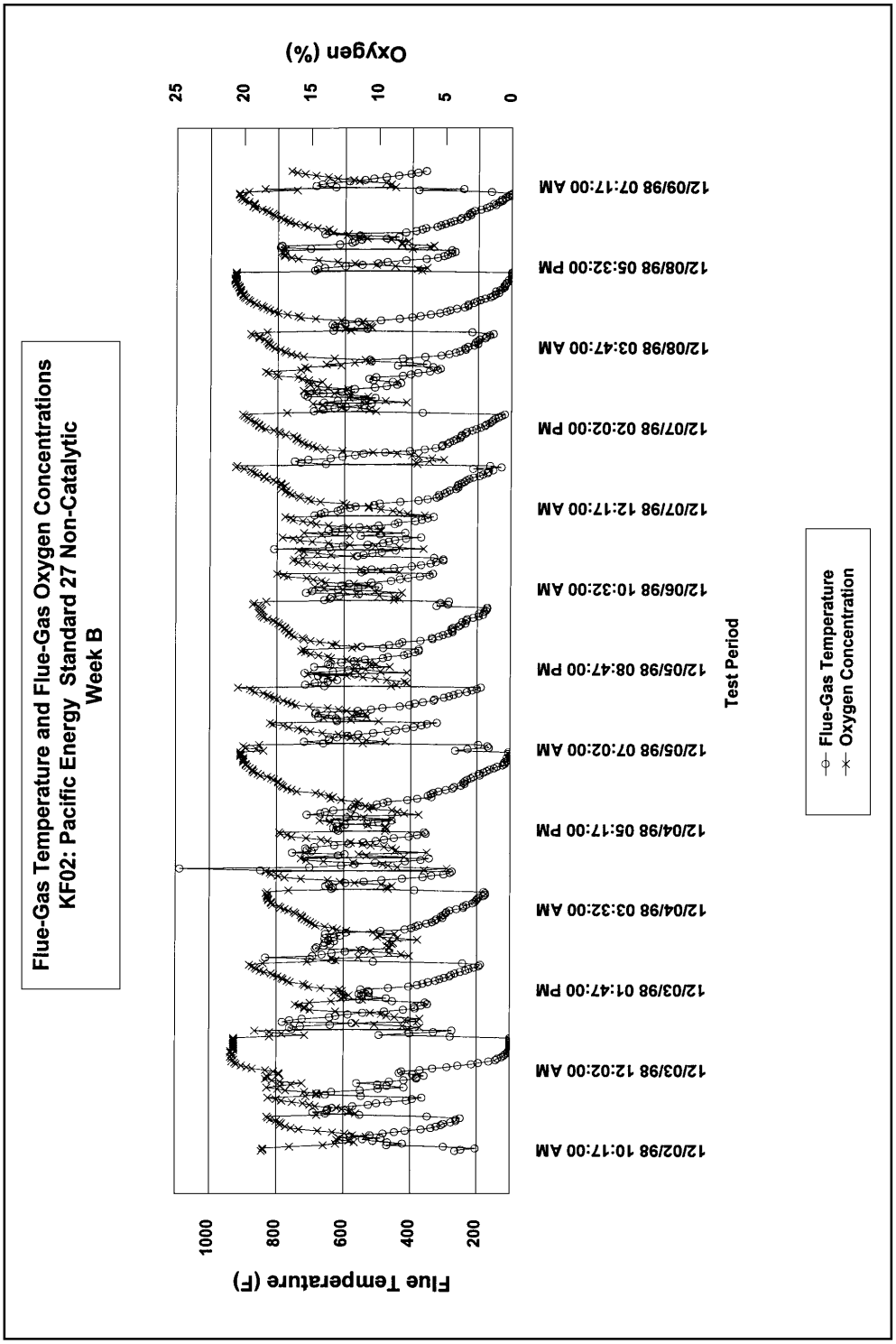
Average Flue-Gas Concentrations

Oxygen (AWES)	**14.52**	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location: Klamath Falls, Oregon USA
Test Run Number: Week C
Test Period Start Date/Time: 12/09/98 11:02:01 AM
Test Period End Date/Time: 12/16/98 10:45:00 AM
Stove Model Tested: **KF02: Pacific Energy Standard 27 Non-Catalytic**
Stove Type: New Tech/Non-Catalytic

Time

Total Test Period	168.00	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	133.75	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	79.6%	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	374	Degrees F	190	Degrees C
Test Facility Ambient Temperature	54	Degrees F	12	Degrees C

ESS Settings

ESS Sampling Rate	1.124	L/Minute
Sample Cycle Duration	15.00	Minutes
Sample Time Per Sample Cycle	120	Seconds

Particulate Emissions

Emission Factor	5.5	G/Kg
Emission Rate	4.9	G/Hour
Concentration	317	Mg/M3

Fuel

Total Fuel Used	142.5	KG With Moisture
Average Fuel Moisture	19.6%	Percent Dry Basis
Total Fuel Burned	119.1	KG Dry
Average Burn Rate During Stove Operation	0.9	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	65.7%
XAD-2	11.3%
Filter	23.0%
Total	100%

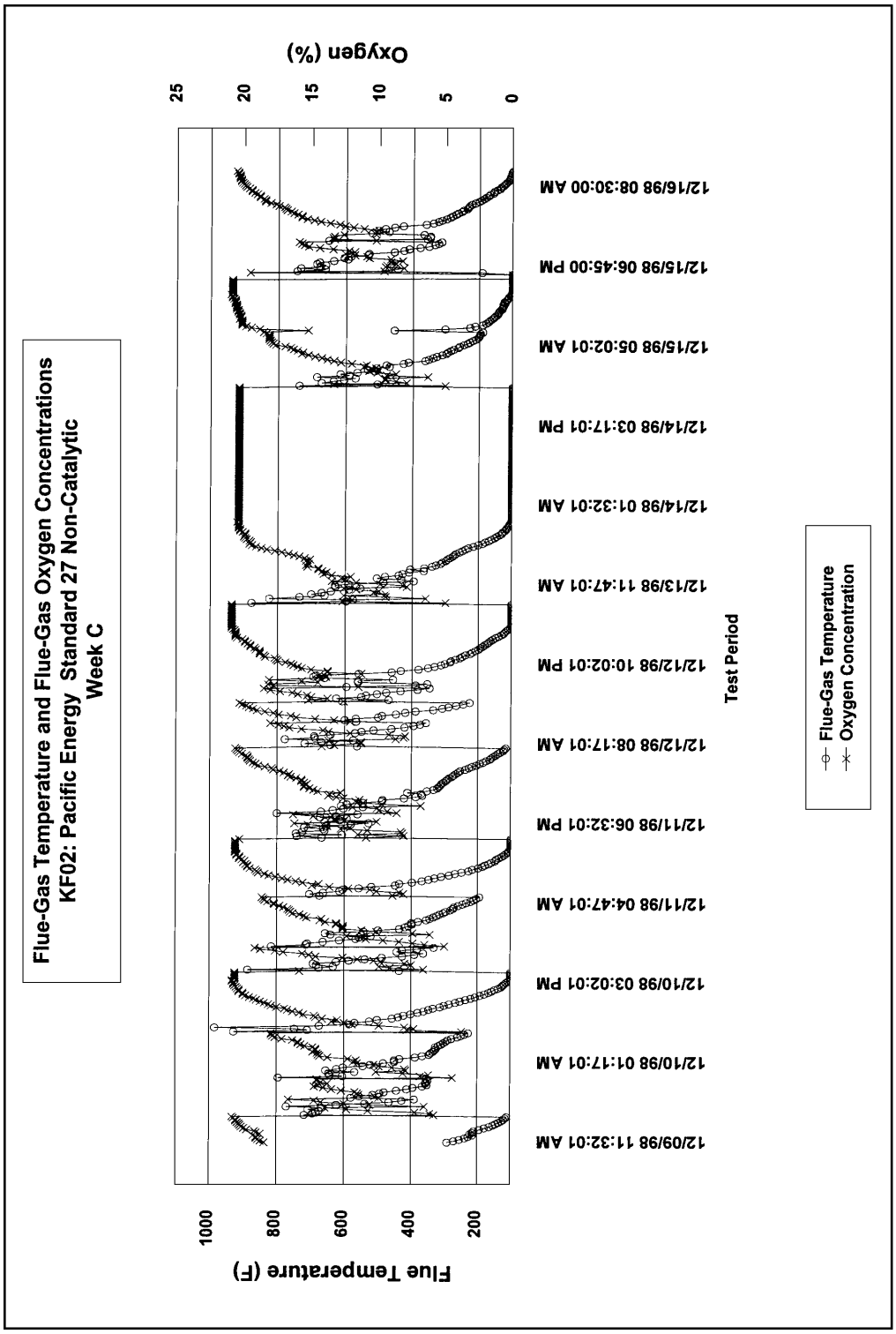
Average Flue-Gas Concentrations

Oxygen (AWES)	15.15	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location: Klamath Falls, Oregon USA
Test Run Number: Week B
Test Period Start Date/Time: 11/22/98 12:01:56 PM
Test Period End Date/Time: 11/29/98 11:46:56 AM
Stove Model Tested: **KF03: Haughs 171E Non-Catalytic**
Stove Type: New Tech/Non-Catalytic

Time

Total Test Period	168.00	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	142.75	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	85.0%	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	430	Degrees F	221	Degrees C
Test Facility Ambient Temperature	75	Degrees F	24	Degrees C

ESS Settings

ESS Sampling Rate	1.038	L/Minute
Sample Cycle Duration	15.00	Minutes
Sample Time Per Sample Cycle	120	Seconds

Particulate Emissions

Emission Factor	3.7	G/Kg
Emission Rate	3.0	G/Hour
Concentration	123	Mg/M3

Fuel

Total Fuel Used	133.8	KG With Moisture
Average Fuel Moisture	14.5%	Percent Dry Basis
Total Fuel Burned	116.8	KG Dry
Average Burn Rate During Stove Operation	0.8	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	41.4%
XAD-2	20.9%
Filter	37.7%
Total	100%

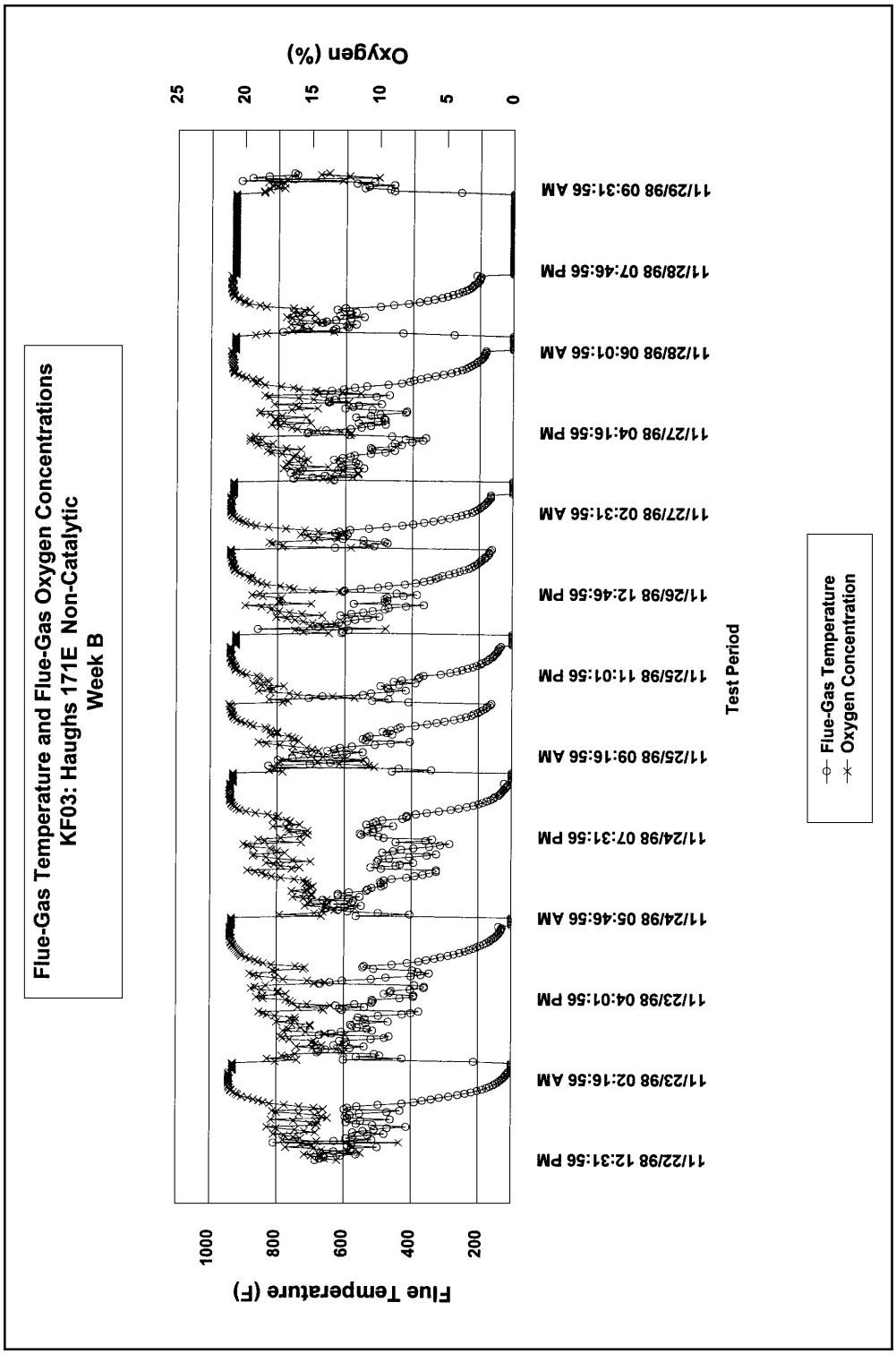
Average Flue-Gas Concentrations

Oxygen (AWES)	17.58	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location:	Klamath Falls, Oregon USA
Test Run Number:	**Week C**
Test Period Start Date/Time:	12/06/98 12:17:02 PM
Test Period End Date/Time:	12/13/98 12:02:02 PM
Stove Model Tested:	**KF03: Haughs 171E Non-Catalytic**
Stove Type:	New Tech/Non-Catalytic

Time

Total Test Period	**168.00**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**160**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**95.2%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**475**	Degrees F	**246**	Degrees C
Test Facility Ambient Temperature	**71**	Degrees F	**22**	Degrees C

ESS Settings

ESS Sampling Rate	**1.038**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**1.9**	G/Kg
Emission Rate	**1.7**	G/Hour
Concentration	**85**	Mg/M3

Fuel

Total Fuel Used	**185.8**	KG With Moisture
Average Fuel Moisture	**18.8%**	Percent Dry Basis
Total Fuel Burned	**139.6**	KG Dry
Average Burn Rate During Stove Operation	**0.9**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**78.2%**
XAD-2	**15.2%**
Filter	**6.5%**
Total	**100%**

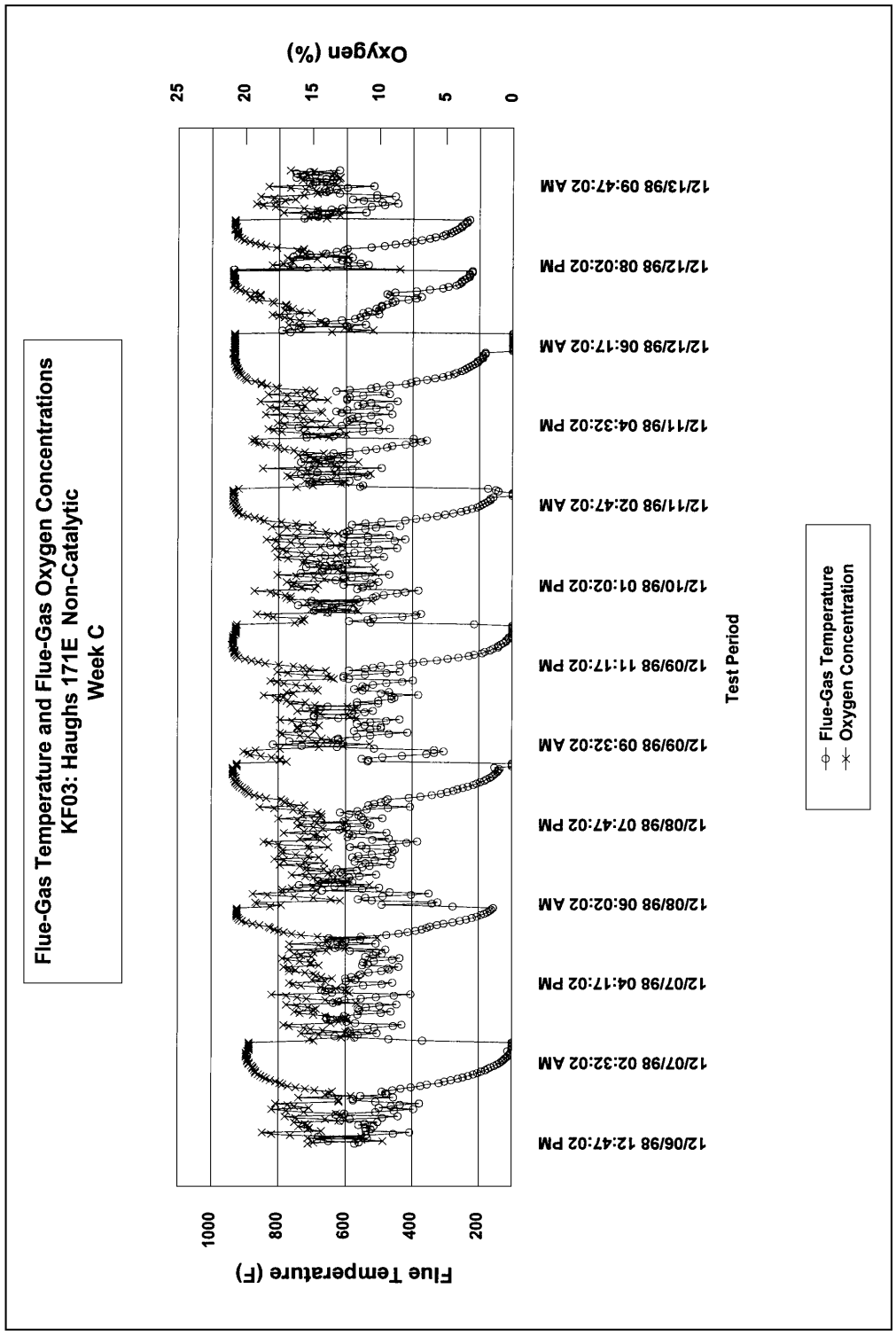
Average Flue-Gas Concentrations

Oxygen (AWES)	**16.52**	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location:	Klamath Falls, Oregon USA
Test Run Number:	**Week A**
Test Period Start Date/Time:	11/14/98 12:32:01 PM
Test Period End Date/Time:	11/21/98 12:17:01 PM
Stove Model Tested:	**KF04: Earthstove 1003-C**
Stove Type:	Catalytic

Time

Total Test Period	**168.00**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**168**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**100.0%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**398**	Degrees F	**203**	Degrees C
Test Facility Ambient Temperature	**75**	Degrees F	**24**	Degrees C

ESS Settings

ESS Sampling Rate	**1.042**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**17.5**	G/Kg
Emission Rate	**15.8**	G/Hour
Concentration	**926**	Mg/M3

Fuel

Total Fuel Used	**184.4**	KG With Moisture
Average Fuel Moisture	**21.6%**	Percent Dry Basis
Total Fuel Burned	**151.6**	KG Dry
Average Burn Rate During Stove Operation	**0.9**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**35.6%**
XAD-2	**34.6%**
Filter	**29.8%**
Total	**100%**

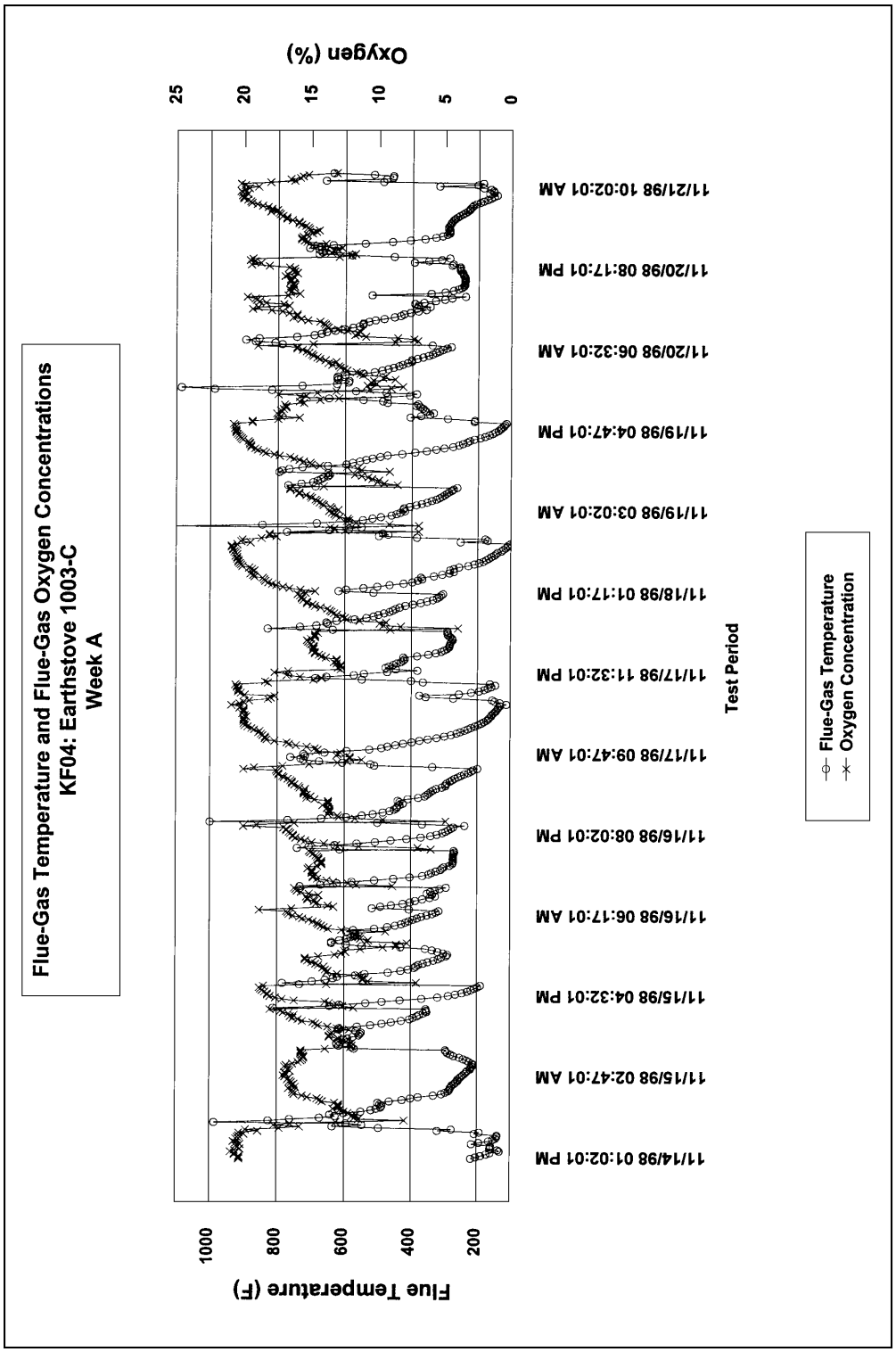
Average Flue-Gas Concentrations

Oxygen (AWES)	**15.42**	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume For This Test is Based on 2.0% of Fuel Carbon Generating Carbon Monoxide and 98.0% of Fuel Carbon Generating Carbon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location:	Klamath Falls, Oregon USA
Test Run Number:	**Week B**
Test Period Start Date/Time:	12/02/98 12:47:00 PM
Test Period End Date/Time:	12/09/98 11:32:00 AM
Stove Model Tested:	**KF04: Earthstove 1003-C**
Stove Type:	Catalytic

Time

Total Test Period	**167.00**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**167**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**100.0%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**510**	Degrees F	**266**	Degrees C
Test Facility Ambient Temperature	**71**	Degrees F	**22**	Degrees C

ESS Settings

ESS Sampling Rate	**1.042**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**14.2**	G/Kg
Emission Rate	**15.1**	G/Hour
Concentration	**1139**	Mg/M3

Fuel

Total Fuel Used	**212.2**	KG With Moisture
Average Fuel Moisture	**19.5%**	Percent Dry Basis
Total Fuel Burned	**177.6**	KG Dry
Average Burn Rate During Stove Operation	**1.1**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**27.7%**
XAD-2	**28.9%**
Filter	**43.4%**
Total	**100%**

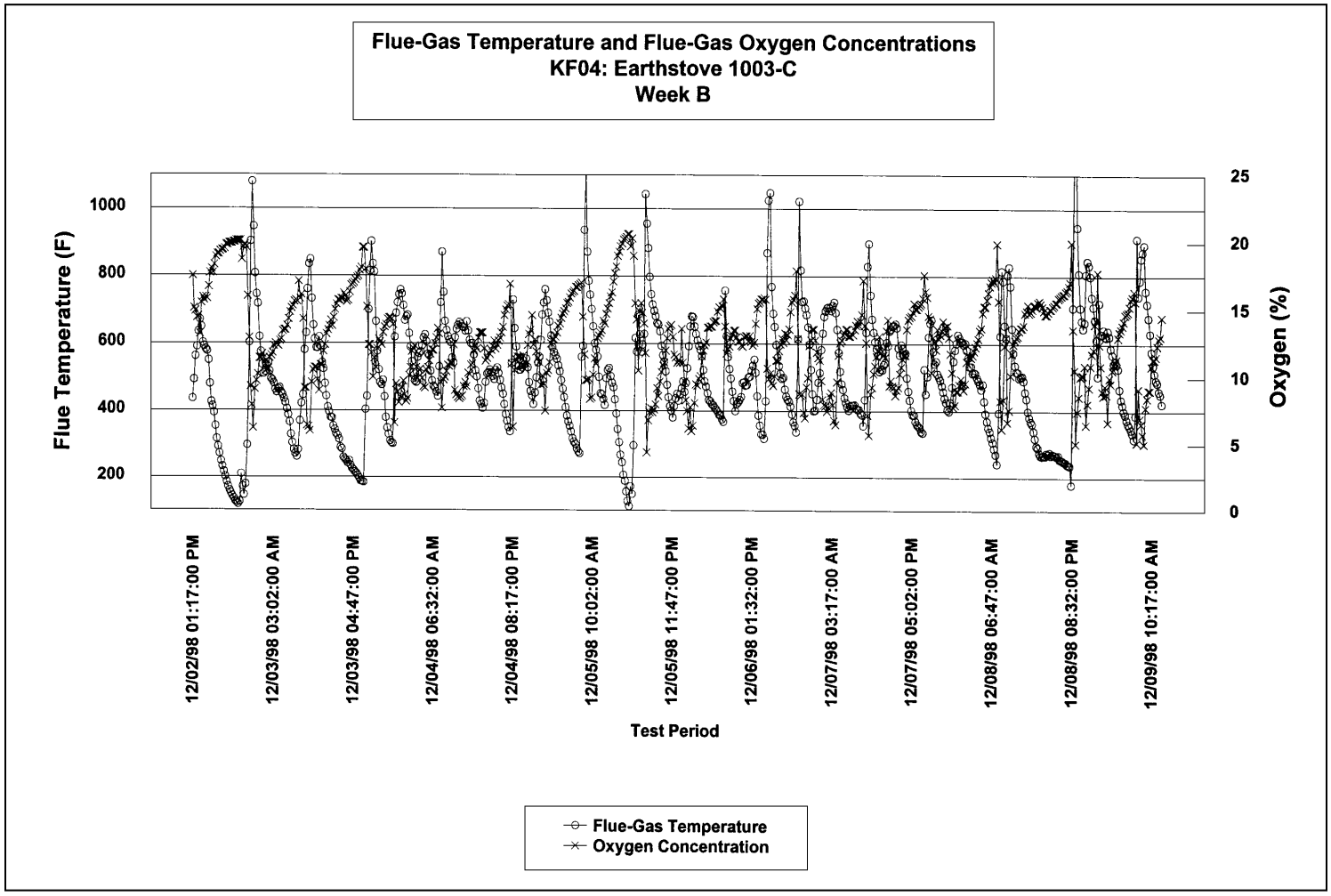
Average Flue-Gas Concentrations

Oxygen (AWES)	**12.59**	Percent

Test Notes:

Test Note Number 1: **Stoichiometric Volume For This Test is Based on 2.0% of Fuel Carbon Generating Carbon Monoxide and 98.0% of Fuel Carbon Generating Carbon Dioxide**

Test Note Number 2: **STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)**



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location:	Klamath Falls, Oregon USA
Test Run Number:	**Week A**
Test Period Start Date/Time:	11/08/98 12:01:54 PM
Test Period End Date/Time:	11/15/98 11:46:54 AM
Stove Model Tested:	**KF05: Pacific Energy Super Series-27 Non-Catalytic**
Stove Type:	New Tech/Non-Catalytic

Time

Total Test Period	**168.00**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**150.75**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**89.7%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**446**	Degrees F	**230**	Degrees C
Test Facility Ambient Temperature	**75**	Degrees F	**24**	Degrees C

ESS Settings

ESS Sampling Rate	**1.069**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**5.2**	G/Kg
Emission Rate	**4.3**	G/Hour
Concentration	**240**	Mg/M3

Fuel

Total Fuel Used	**137.7**	KG With Moisture
Average Fuel Moisture	**10.4%**	Percent Dry Basis
Total Fuel Burned	**124.7**	KG Dry
Average Burn Rate During Stove Operation	**0.8**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**47.7%**
XAD-2	**29.9%**
Filter	**22.3%**
Total	**100%**

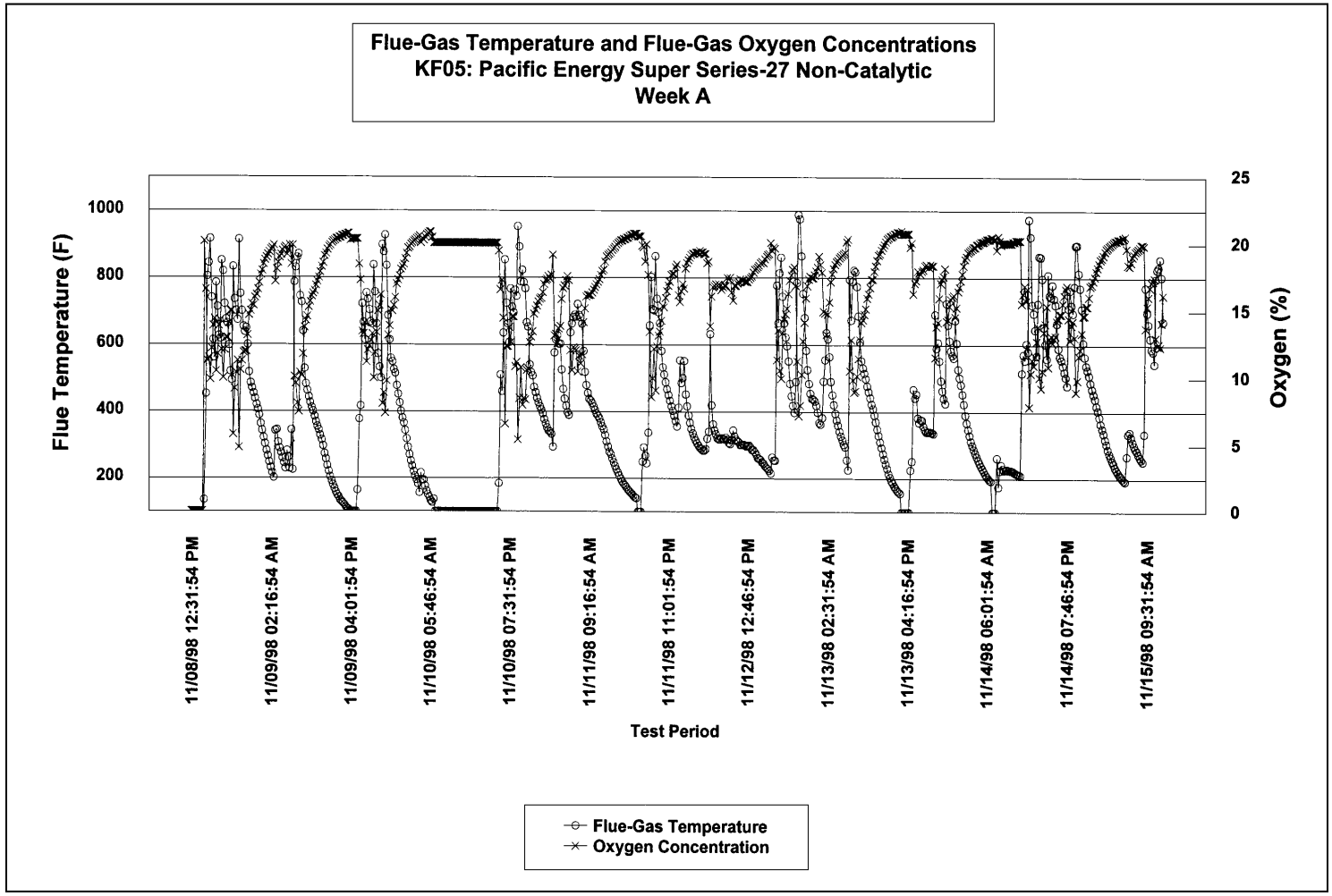
Average Flue-Gas Concentrations

Oxygen (AWES)	**16.28**	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location:	Klamath Falls, Oregon USA
Test Run Number:	**Week B**
Test Period Start Date/Time:	11/22/98 12:01:55 PM
Test Period End Date/Time:	11/25/98 06:16:55 PM
Stove Model Tested:	**KF05: Pacific Energy Super Series-27 Non-Catalytic**
Stove Type:	New Tech/Non-Catalytic

Time

Total Test Period	**78.50**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**75.5**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**96.2%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**404**	Degrees F	**207**	Degrees C
Test Facility Ambient Temperature	**74**	Degrees F	**23**	Degrees C

ESS Settings

ESS Sampling Rate	**1.069**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**7.2**	G/Kg
Emission Rate	**6.1**	G/Hour
Concentration	**300**	Mg/M3

Fuel

Total Fuel Used	**70.7**	KG With Moisture
Average Fuel Moisture	**9.8%**	Percent Dry Basis
Total Fuel Burned	**64.4**	KG Dry
Average Burn Rate During Stove Operation	**0.9**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**66.0%**
XAD-2	**12.7%**
Filter	**21.3%**
Total	**100%**

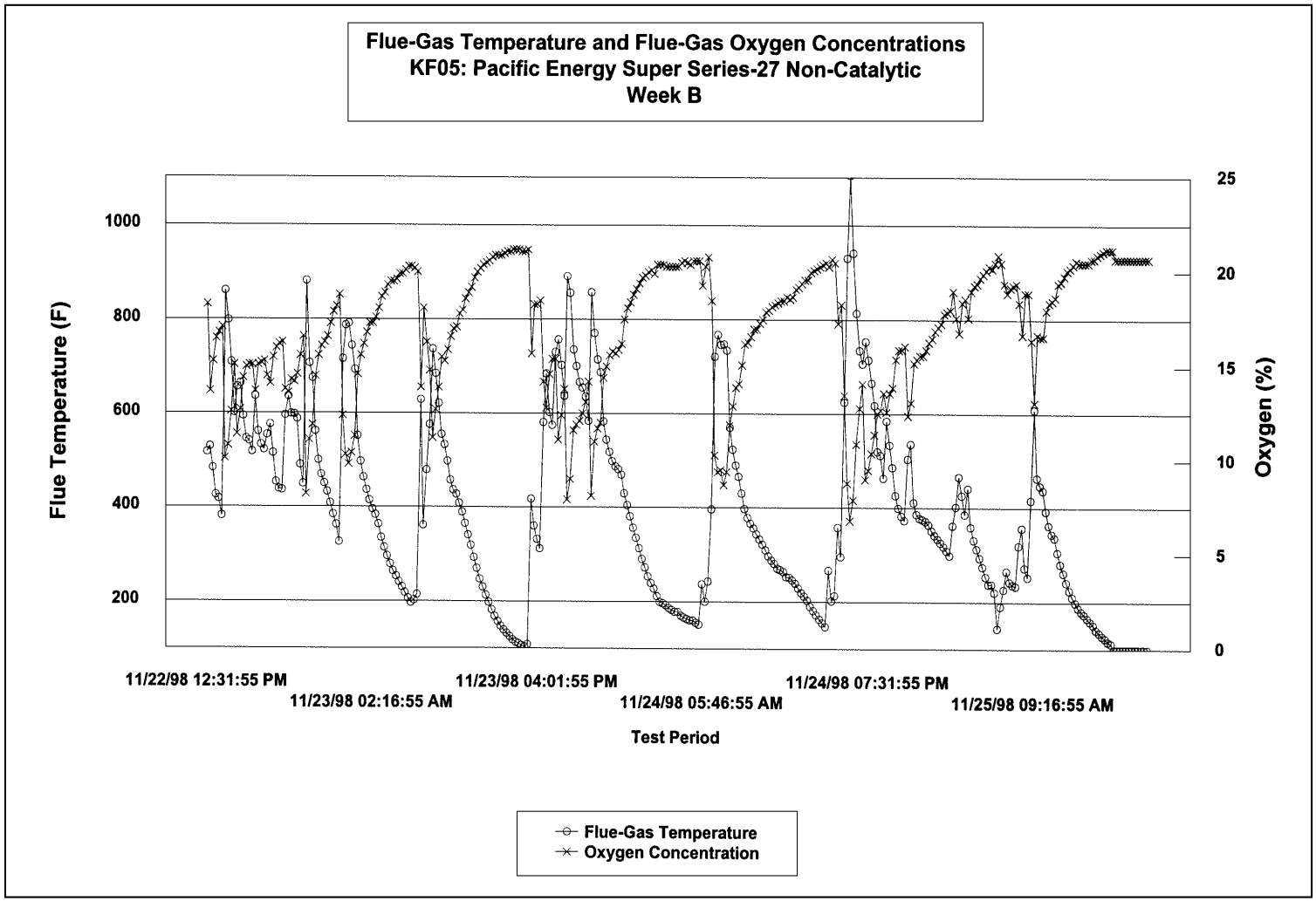
Average Flue-Gas Concentrations

Oxygen (AWES)	**16.73**	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location: Klamath Falls, Oregon USA
Test Run Number: Week C
Test Period Start Date/Time: 12/08/98 12:17:01 PM
Test Period End Date/Time: 12/15/98 12:02:01 PM
Stove Model Tested: **KF05: Pacific Energy Super Series-27 Non-Catalytic**
Stove Type: New Tech/Non-Catalytic

Time

Total Test Period	168.00	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	153	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	91.1%	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	470	Degrees F	243	Degrees C
Test Facility Ambient Temperature	63	Degrees F	17	Degrees C

ESS Settings

ESS Sampling Rate	1.069	L/Minute
Sample Cycle Duration	15.00	Minutes
Sample Time Per Sample Cycle	120	Seconds

Particulate Emissions

Emission Factor	2.8	G/Kg
Emission Rate	2.8	G/Hour
Concentration	147	Mg/M3

Fuel

Total Fuel Used	172.2	KG With Moisture
Average Fuel Moisture	11.3%	Percent Dry Basis
Total Fuel Burned	154.7	KG Dry
Average Burn Rate During Stove Operation	1.0	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	38.5%
XAD-2	25.8%
Filter	35.7%
Total	100%

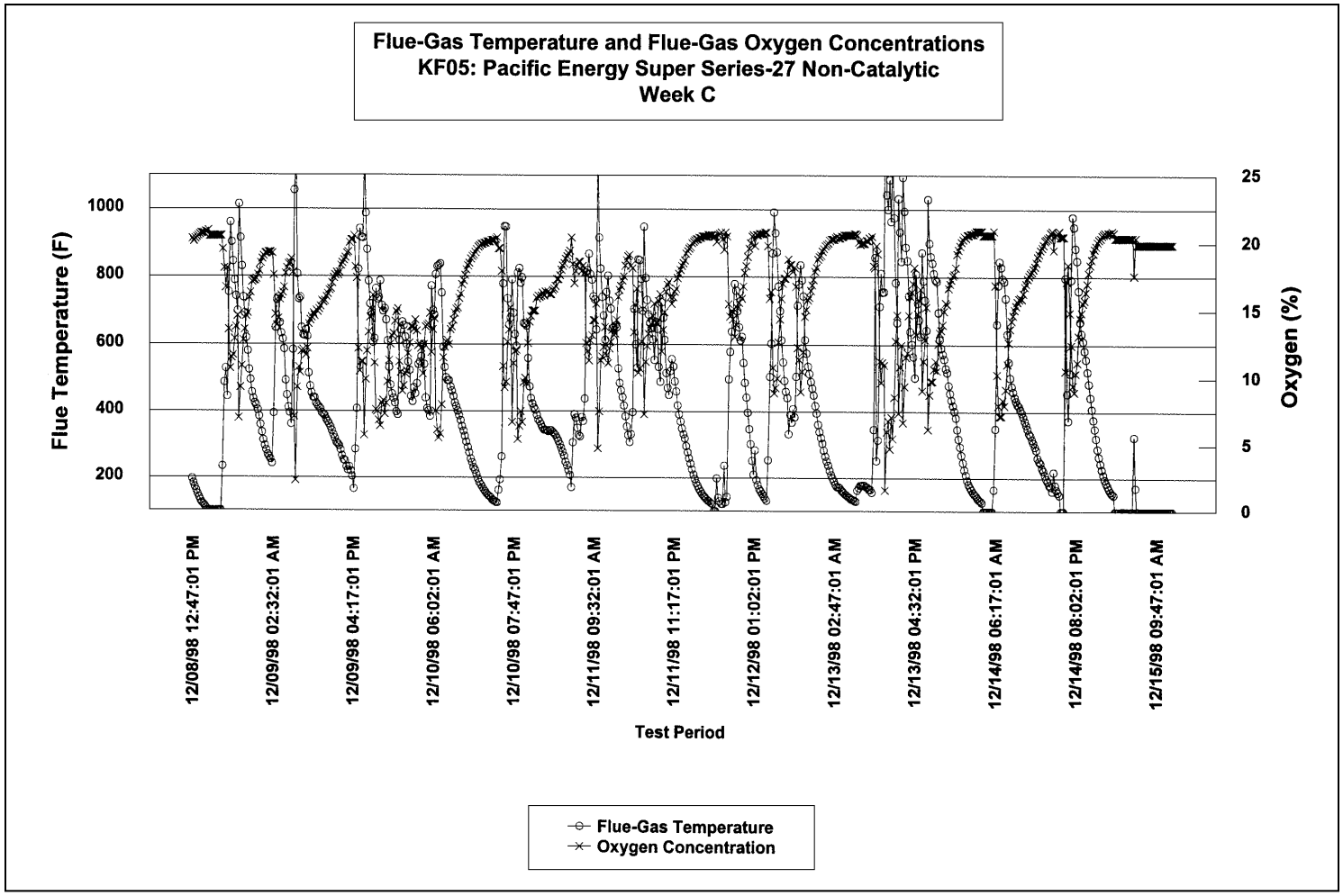
Average Flue-Gas Concentrations

Oxygen (AWES)	15.71	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location: Klamath Falls, Oregon USA
Test Run Number: Week A
Test Period Start Date/Time: 11/10/98 12:17:00 PM
Test Period End Date/Time: 11/17/98 12:02:00 PM
Stove Model Tested: **KF06: Waterford 104.MKII**
Stove Type: New Tech/Non-Catalytic

Time

Total Test Period	168.00	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	168	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	100.0%	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	431	Degrees F	222	Degrees C
Test Facility Ambient Temperature	77	Degrees F	25	Degrees C

ESS Settings

ESS Sampling Rate	1.145	L/Minute
Sample Cycle Duration	15.00	Minutes
Sample Time Per Sample Cycle	120	Seconds

Particulate Emissions

Emission Factor	6.0	G/Kg
Emission Rate	4.0	G/Hour
Concentration	295	Mg/M3

Fuel

Total Fuel Used	126.0	KG With Moisture
Average Fuel Moisture	11.7%	Percent Dry Basis
Total Fuel Burned	112.8	KG Dry
Average Burn Rate During Stove Operation	0.7	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	47.1%
XAD-2	18.3%
Filter	34.7%
Total	100%

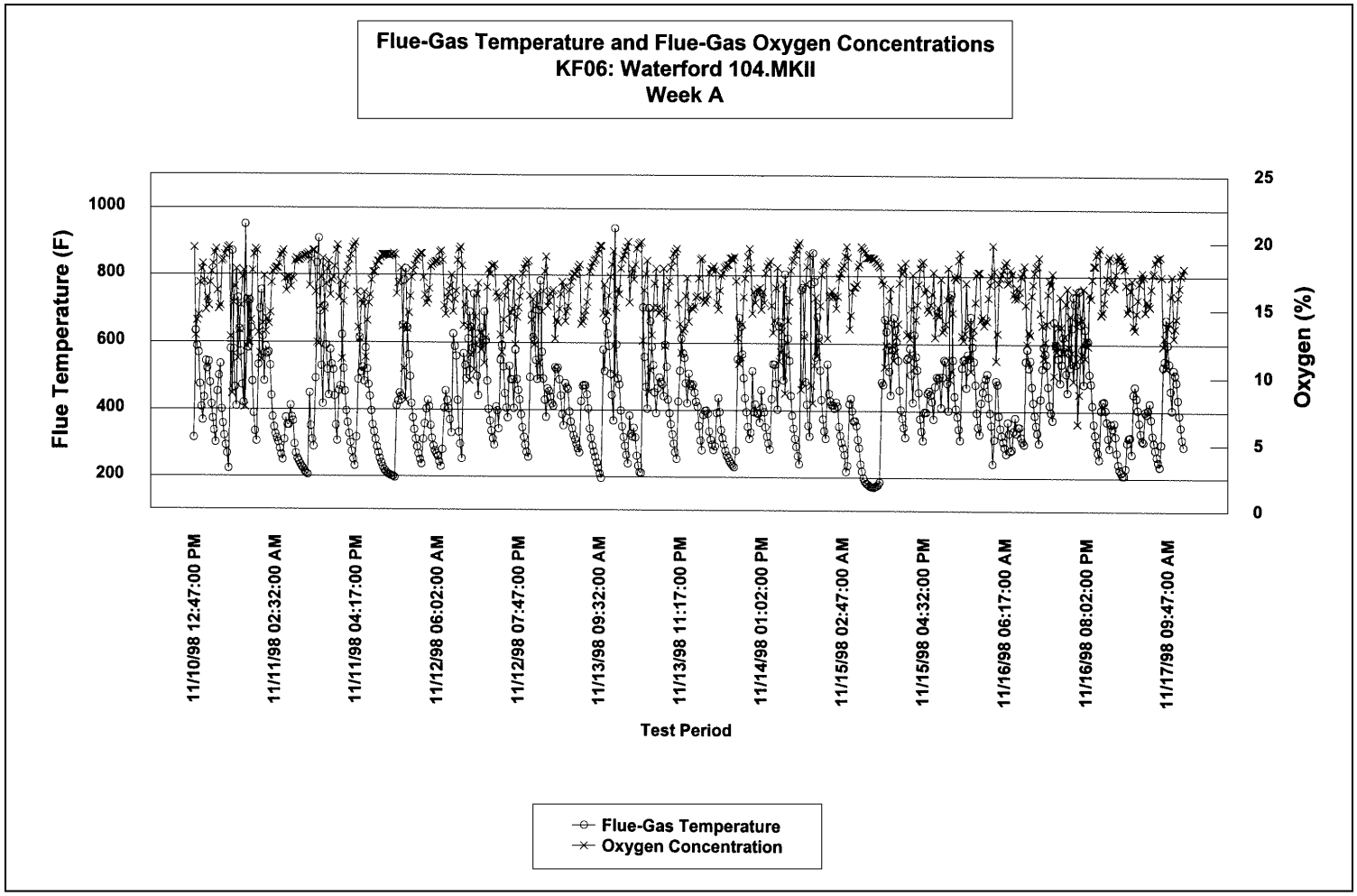
Average Flue-Gas Concentrations

Oxygen (AWES)	16.00	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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Manufacturer: Aladdin Hearth Products
Model: DV40-Step
Date: 6/11/98
LP Gas

Alcove height 56 inch Alcove Depth 36 inches
2 foot vertical to 1 foot horizontal
3inches to switch box - 8 inches to pipe
12 inches to Alcove 6 inches to Rear wall

Technician Bruce Davis
Supervisor Richard Sparwasser
Project No 061-S-04-5

Safety Thermal Testing

		Interval 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Location	TC#	09:45 AM	10:15 AM	10:45 AM												
Ambient		75	75	76												
Panel A: Floor																
	0	NA	NA	NA												
	1	104	109	112												
	2	112	126	134												
	3	NA	NA	NA												
	4	101	114	122												
	5	101	107	110												
	6	69	72	75												
	7	69	71	72												
	8	70	71	72												
	9	70	75	72												
	10	70	71	72												
	11	68	69	70												
	12	69	70	72												
	13	70	71	72												
	14	70	71	72												
	15	69	71	72												
Panel B: Rear Wall / Ceiling																
	33	144	152	151												
	34	219	224	225												
	35	158	162	163												
	36	131	135	136												
	37	217	218	219												
	38	161	161	161												
Panel C: Side Wall																
	46	72	73	74												
	47	74	75	76												
	48	75	77	78												
	49	NA	NA	NA												
	50	112	117	119												
	51	127	132	135												
	52	106	110	112												
	53	113	114	115												
	54	97	99	101												
	55	89	92	94												
	56	129	134	136												
	57	158	164	166												
	58	191	196	199												
	59	134	138	140												
	60	123	124	125												
	61	92	94	96												
	62	90	92	94												
	63	108	123	126												
	64	137	141	142												
	65	193	197	200												
	66	133	137	139												
	67	125	126	125												
	68	90	93	95												
	69	90	93	95												
	70	123	127	129												
	71	145	149	151												
	72	166	170	172												
	73	132	135	137												
	74	114	113	115												
	75	107	110	111												
	76	98	100	101												
	77	108	111	113												
	78	117	119	120												
	79	124	127	128												
	80	145	147	148												
Miscellaneous																
Ceiling	81	88	92	91												
Wire Ambie	2	228	230	229												
Top Switch	3	189	190	190												
Chase Top	4	100	102	104												
Chase Top	5	86	88	90												
Chase Top	6	92	94	95												
Chase Side	7	86	87	88												
Door Handl	8	118	121	120												
Flue	9	556	557	558												
Ceiling	10	145	148	148												
Ceiling	11	88	92	91												
Valve Body	20	136	136	138												

AWES-Emissions Results

Project Name: ERG/EPA

Residence Location:	Klamath Falls, Oregon USA
Test Run Number:	**Week A**
Test Period Start Date/Time:	11/08/98 12:01:54 PM
Test Period End Date/Time:	11/16/98 02:32:01 PM
Stove Model Tested:	**KF07: Earthstove 1400HT Non-Catalytic**
Stove Type:	New Tech/Non-Catalytic

Time

Total Test Period	**168.25**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**167.75**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**99.7%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**424**	Degrees F	**218**	Degrees C
Test Facility Ambient Temperature	**75**	Degrees F	**24**	Degrees C

ESS Settings

ESS Sampling Rate	**1.109**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**9.9**	G/Kg
Emission Rate	**8.3**	G/Hour
Concentration	**418**	Mg/M3

Fuel

Total Fuel Used	**158.5**	KG With Moisture
Average Fuel Moisture	**12.6%**	Percent Dry Basis
Total Fuel Burned	**140.8**	KG Dry
Average Burn Rate During Stove Operation	**0.8**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**42.7%**
XAD-2	**19.8%**
Filter	**37.5%**
Total	**100%**

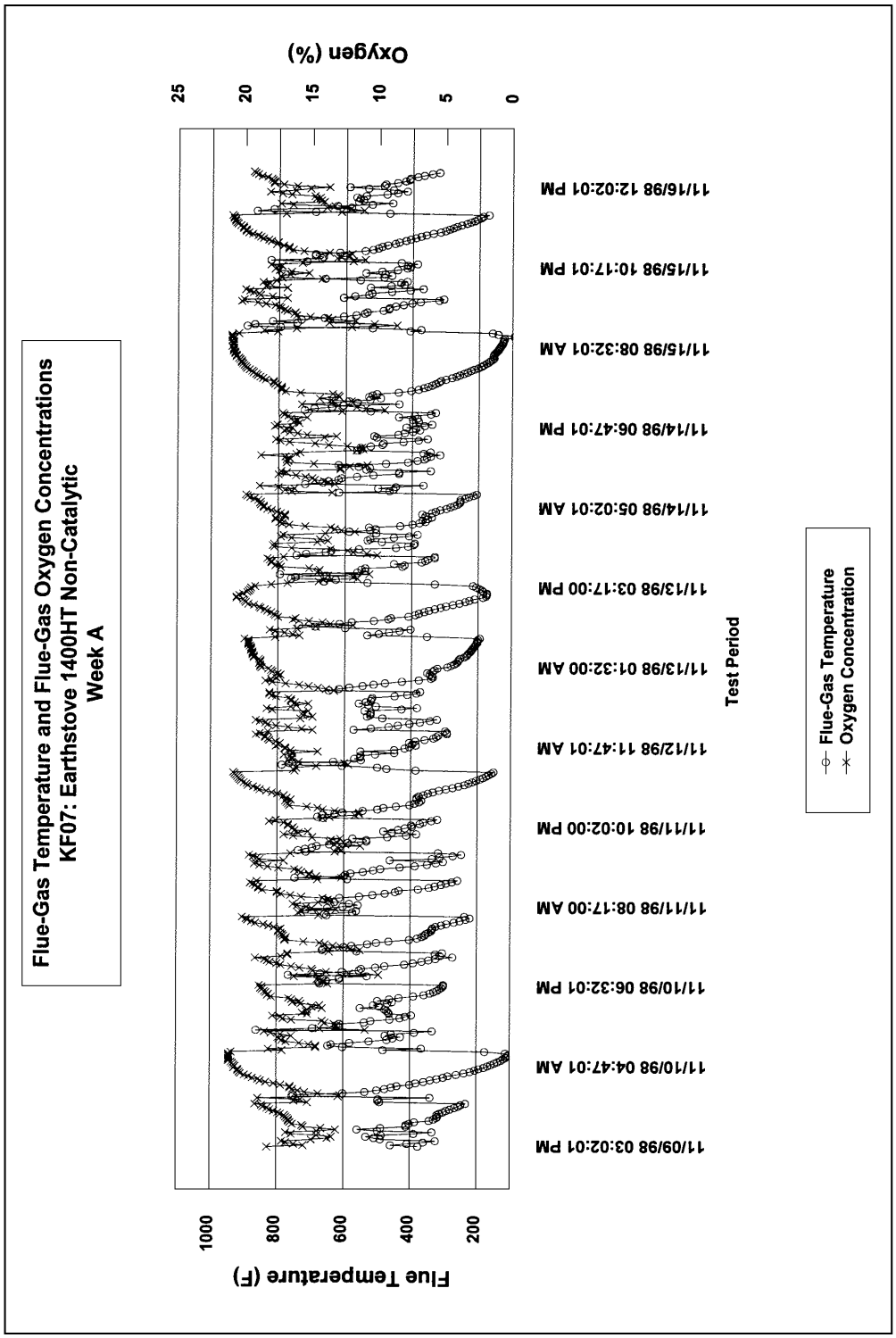
Average Flue-Gas Concentrations

Oxygen (AWES)	**16.72**	Percent

Test Notes:

Test Note Number 1: **Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide**

Test Note Number 2: **STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)**



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location:	Klamath Falls, Oregon USA
Test Run Number:	**Week B**
Test Period Start Date/Time:	11/22/98 12:01:54 PM
Test Period End Date/Time:	11/29/98 11:46:54 AM
Stove Model Tested:	**KF07: Earthstove 1400HT Non-Catalytic**
Stove Type:	New Tech/Non-Catalytic

Time

Total Test Period	**168.00**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**160.25**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**95.4%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**457**	Degrees F	**236**	Degrees C
Test Facility Ambient Temperature	**75**	Degrees F	**21**	Degrees C

ESS Settings

ESS Sampling Rate	**1.109**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**7.9**	G/Kg
Emission Rate	**5.9**	G/Hour
Concentration	**324**	Mg/M3

Fuel

Total Fuel Used	**133.7**	KG With Moisture
Average Fuel Moisture	**11.7%**	Percent Dry Basis
Total Fuel Burned	**119.7**	KG Dry
Average Burn Rate During Stove Operation	**0.7**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**44.0%**
XAD-2	**22.5%**
Filter	**33.5%**
Total	**100%**

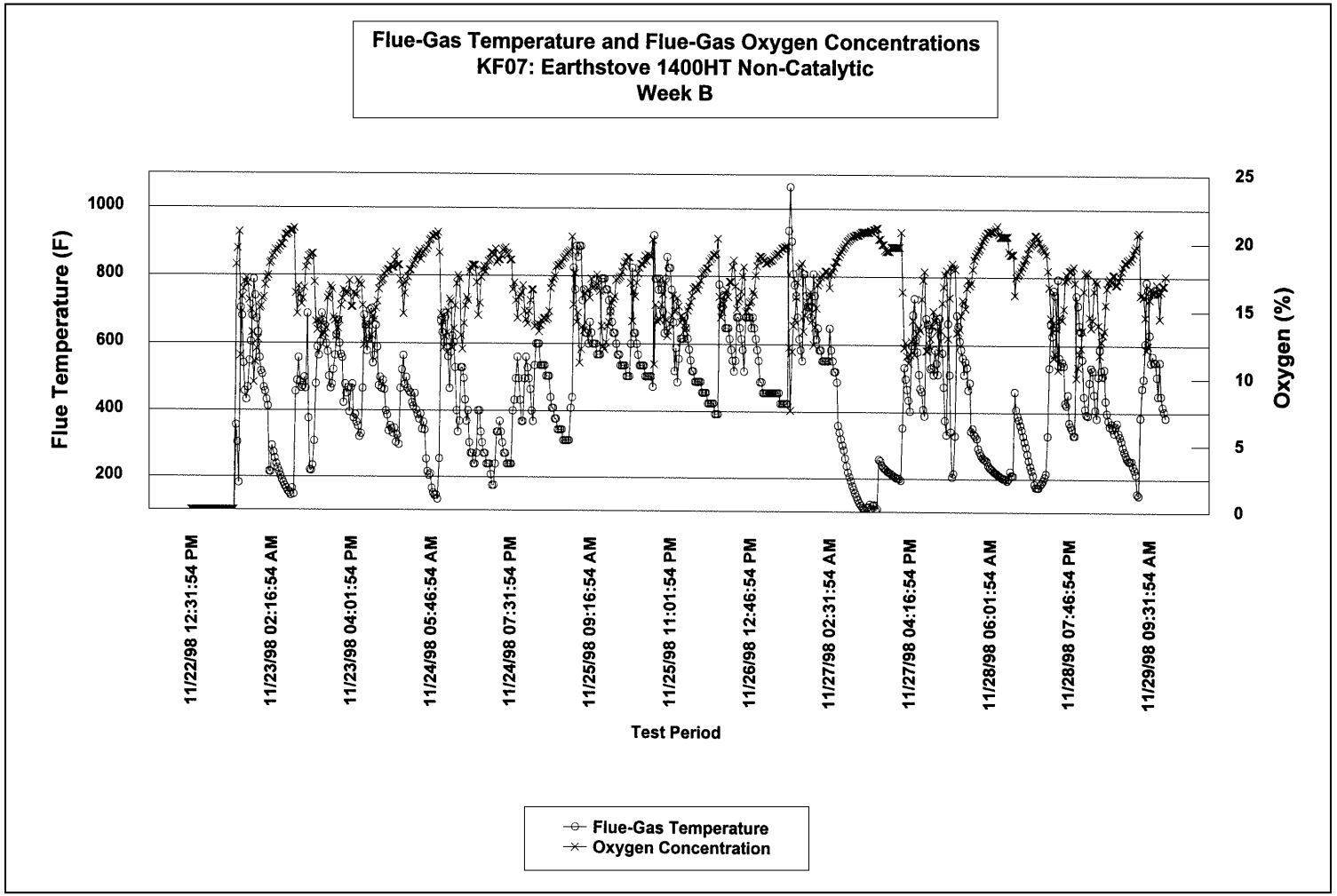
Average Flue-Gas Concentrations

Oxygen (AWES)	**16.83**	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location: Klamath Falls, Oregon USA
Test Run Number: Week C
Test Period Start Date/Time: 12/06/98 12:01:54 PM
Test Period End Date/Time: 12/13/98 11:47:28 AM
Stove Model Tested: **KF07: Earthstove 1400HT Non-Catalytic**
Stove Type: New Tech/Non-Catalytic

Time

Total Test Period	**168.00**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**165.75**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**98.7%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**484**	Degrees F	**251**	Degrees C
Test Facility Ambient Temperature	**74**	Degrees F	**23**	Degrees C

ESS Settings

ESS Sampling Rate	**1.109**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**8.2**	G/Kg
Emission Rate	**9.7**	G/Hour
Concentration	**434**	Mg/M3

Fuel

Total Fuel Used	**225.4**	KG With Moisture
Average Fuel Moisture	**15.8%**	Percent Dry Basis
Total Fuel Burned	**194.7**	KG Dry
Average Burn Rate During Stove Operation	**1.2**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**49.0%**
XAD-2	**14.6%**
Filter	**36.4%**
Total	**100%**

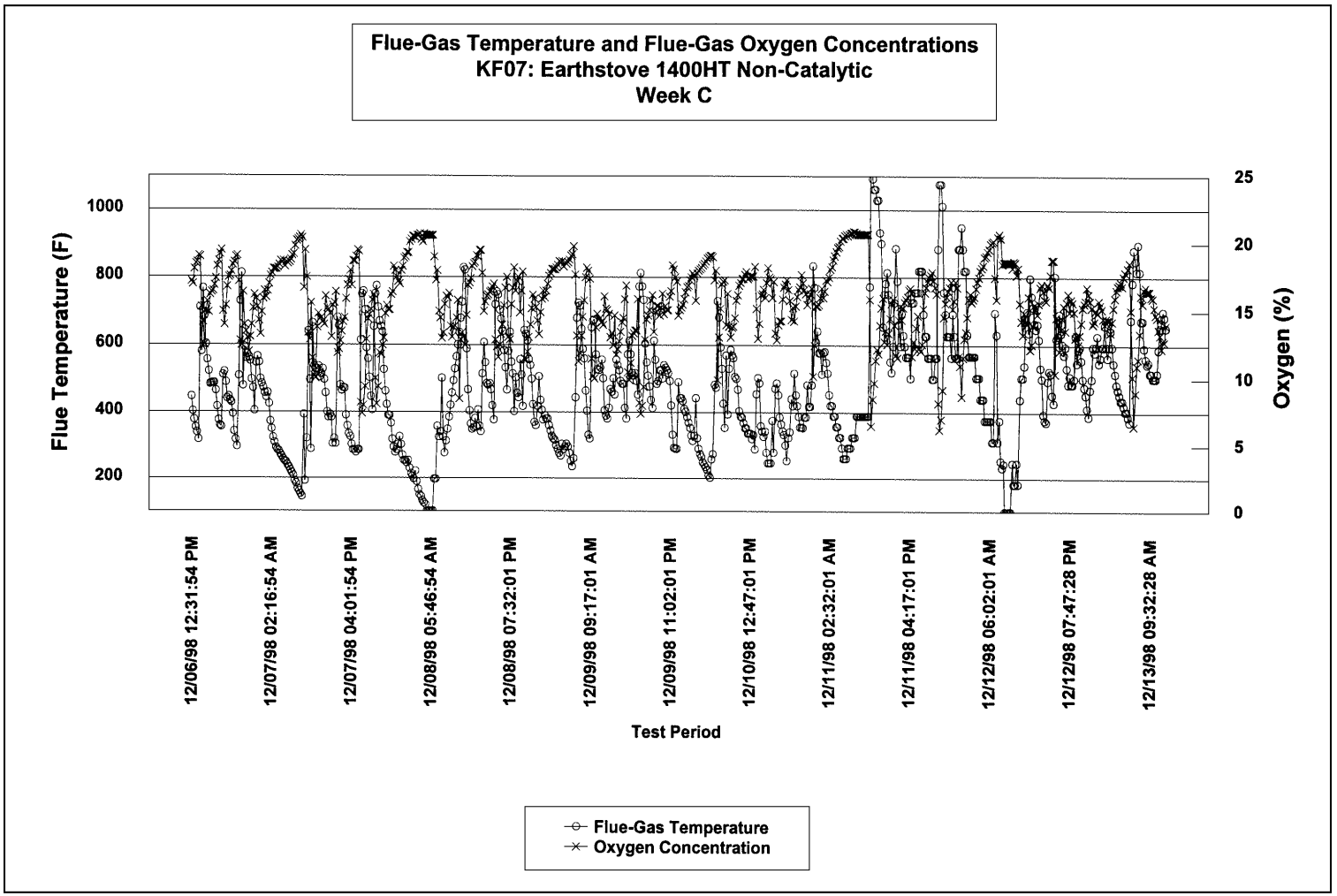
Average Flue-Gas Concentrations

Oxygen (AWES)	**15.64**	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location:	Klamath Falls, Oregon USA
Test Run Number:	**Week A**
Test Period Start Date/Time:	11/08/98 12:01:54 PM
Test Period End Date/Time:	11/15/98 11:46:54 AM
Stove Model Tested:	**KF08: Country T-Top Non-Catalytic**
Stove Type:	New Tech/Non-Catalytic

Time

Total Test Period	**168.00**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**168**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**100.0%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**384**	Degrees F	**195**	Degrees C
Test Facility Ambient Temperature	**79**	Degrees F	**26**	Degrees C

ESS Settings

ESS Sampling Rate	**1.058**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**8.9**	G/Kg
Emission Rate	**9.9**	G/Hour
Concentration	**395**	Mg/M3

Fuel

Total Fuel Used	**238.4**	KG With Moisture
Average Fuel Moisture	**26.8%**	Percent Dry Basis
Total Fuel Burned	**188.0**	KG Dry
Average Burn Rate During Stove Operation	**1.1**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**55.8%**
XAD-2	**17.0%**
Filter	**27.3%**
Total	**100%**

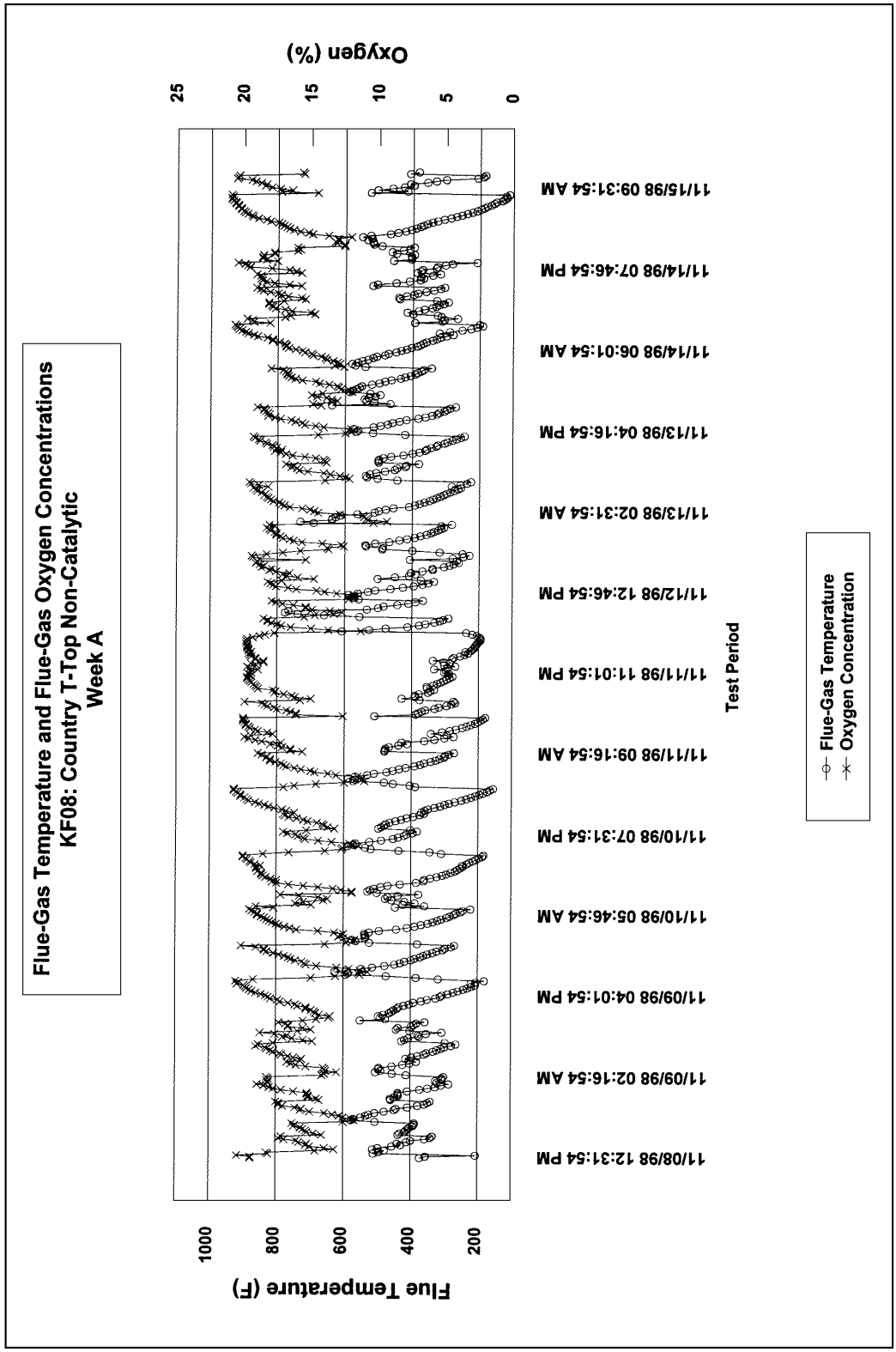
Average Flue-Gas Concentrations

Oxygen (AWES)	**16.47**	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location:	Klamath Falls, Oregon USA
Test Run Number:	**Week B**
Test Period Start Date/Time:	11/22/98 12:01:53 PM
Test Period End Date/Time:	11/30/98 06:06:43 PM
Stove Model Tested:	**KF08: Country T-Top Non-Catalytic**
Stove Type:	New Tech/Non-Catalytic

Time

Total Test Period	**172.75**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**169.75**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**98.3%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**428**	Degrees F	**220**	Degrees C
Test Facility Ambient Temperature	**75**	Degrees F	**24**	Degrees C

ESS Settings

ESS Sampling Rate	**1.058**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**12.3**	G/Kg
Emission Rate	**13.6**	G/Hour
Concentration	**421**	Mg/M3

Fuel

Total Fuel Used	**237.1**	KG With Moisture
Average Fuel Moisture	**25.4%**	Percent Dry Basis
Total Fuel Burned	**189.0**	KG Dry
Average Burn Rate During Stove Operation	**1.1**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**39.1%**
XAD-2	**4.3%**
Filter	**56.6%**
Total	**100%**

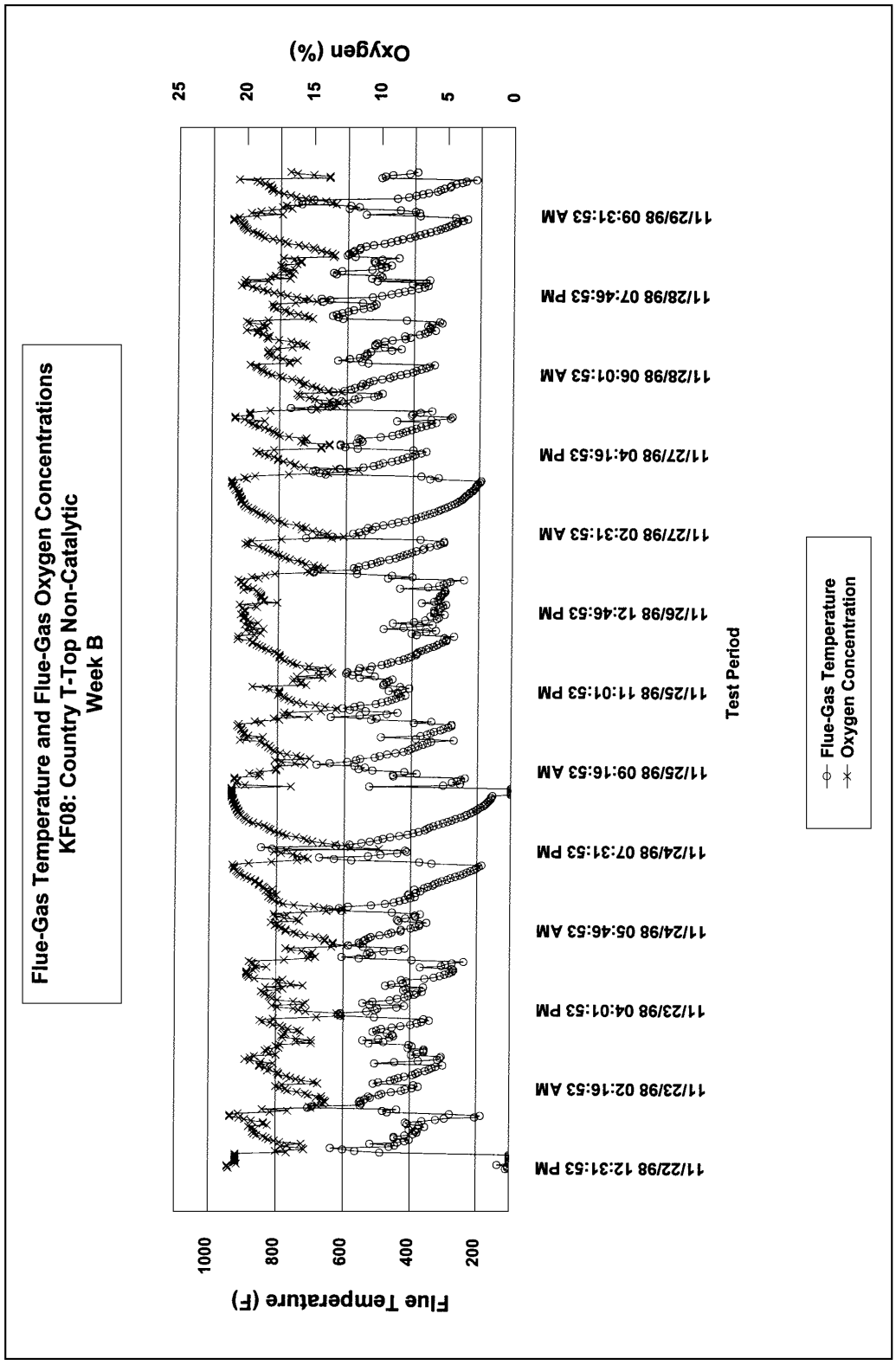
Average Flue-Gas Concentrations

Oxygen (AWES)	**17.48**	Percent

Test Notes:

Test Note Number 1: Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide

Test Note Number 2: STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)



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AWES-Emissions Results

Project Name: ERG/EPA

Residence Location:	Klamath Falls, Oregon USA
Test Run Number:	**Week C**
Test Period Start Date/Time:	12/05/98 07:24:15 PM
Test Period End Date/Time:	12/13/98 11:55:09 AM
Stove Model Tested:	**KF08: Country T-Top Non-Catalytic**
Stove Type:	New Tech/Non-Catalytic

Time

Total Test Period	**171.00**	Hours
Stove Operating Time (ie, Flue-Gas Temperature Over 100 Degrees F)	**170.5**	Hours
Stove Operating Time During Test Period (ie, Flue-Gas Temperature Over 100 Degrees F)	**99.7%**	

Average Temperatures

Flue-Gas Temperature (at 1 foot above flue collar)	**446**	Degrees F	**230**	Degrees C
Test Facility Ambient Temperature	**74**	Degrees F	**24**	Degrees C

ESS Settings

ESS Sampling Rate	**1.058**	L/Minute
Sample Cycle Duration	**15.00**	Minutes
Sample Time Per Sample Cycle	**120**	Seconds

Particulate Emissions

Emission Factor	**5.2**	G/Kg
Emission Rate	**6.3**	G/Hour
Concentration	**254**	Mg/M3

Fuel

Total Fuel Used	**257.7**	KG With Moisture
Average Fuel Moisture	**25.7%**	Percent Dry Basis
Total Fuel Burned	**205.0**	KG Dry
Average Burn Rate During Stove Operation	**1.2**	KG/Hour (dry)

Breakdown of Particulate Sample

Rinse	**57.8%**
XAD-2	**17.9%**
Filter	**24.3%**
Total	**100%**

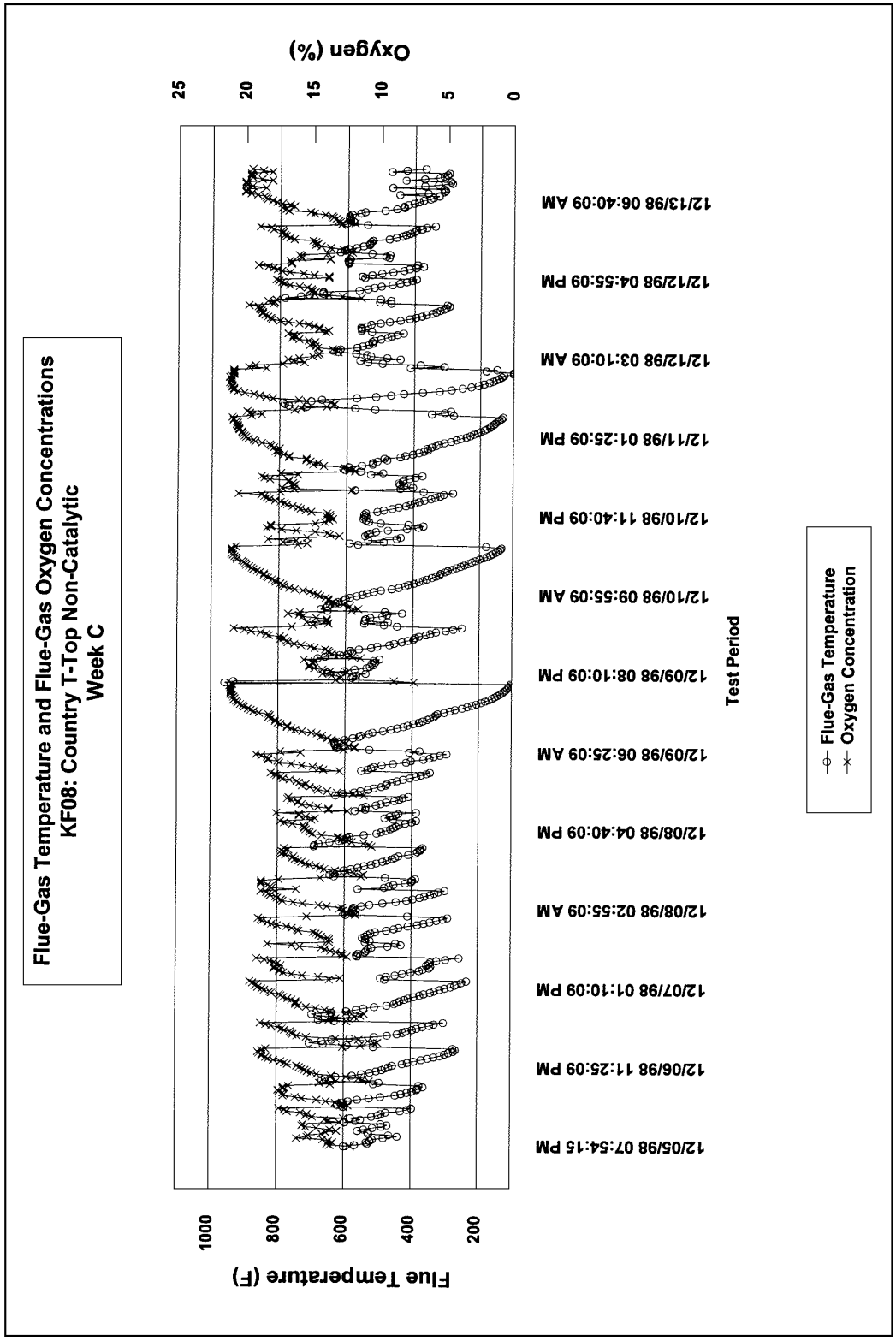
Average Flue-Gas Concentrations

Oxygen (AWES)	**16.08**	Percent

Test Notes:

Test Note Number 1: **Stoichiometric Volume is Based on 11.5% of Fuel Carbon Generating Carbon Monoxide and 88.5% of Fuel Carbon Generating Cabon Dioxide**

Test Note Number 2: **STP for this test is: 1.00 Atmosphere and 68 Degrees F (20 Degrees C)**



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